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Dark Gamma-ray Burst Mystery Unraveling

Most "missing" optical afterglows of gamma-ray bursts may simply fade away before we can spot them.

by Vanessa Thomas

Gamma-ray bursts are the universe's most powerful explosions but typically last only seconds or minutes. *David A. Aguilar / CfA*

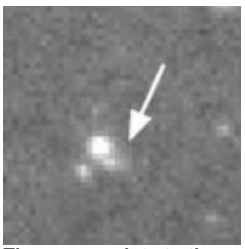
Gamma-ray bursts are notoriously sly — most disappear seconds after they explode onto the cosmic scene. The best way we have to study these furtive fellows is by locating and studying their lingering x-ray or optical afterglows. But about two-thirds of the time, astronomers haven't been able to find the optical afterglows of these things either.

Astronomers have speculated that perhaps these "dark" gamma-ray bursts simply don't have optical afterglows — or at least not ones we can observe. But observations from the alert High Energy Transient Explorer 2 (HETE-2) spacecraft suggests that maybe we just haven't been quick enough on the draw. The afterglows are probably there, but they fade almost as rapidly as their gamma-ray predecessors.

At the 2003 Gamma-Ray Burst Conference in Santa Fe, New Mexico, last week, an international team of scientists presented an analysis of 15 gamma-ray bursts (GRBs) located by HETE-2's Soft X-ray Camera in the past year.

Of those, only one of these had no detected optical afterglow, rather than the 10 the team expected to be dark based on previous studies.

"For years, we thought of dark gamma-ray bursts as being more unsociable than the Cheshire Cat, not having the courtesy to leave a visible smile behind when they faded away," said HETE principal investigator and MIT researcher George Ricker. "Now we're finally seeing that smile."



The arrow points to the first optical afterglow of a "dark" gamma-ray burst ever observed. *P. Wozniak, W.T. Vestrand, et al. / RAPTOR Project / LANL*

When HETE-2 discovers a burst and determines its location, this

NASA's HETE-2 satellite detects and localizes gamma-ray bursts.
NASA

information is relayed to a global network of astronomers who search for afterglows. Ricker and his colleagues suspect that more optical afterglows have been found in the past year because astronomers are searching HETE-2's discovery locations more quickly and carefully than before, or perhaps because GRBs discovered with the Soft X-ray Camera have brighter optical glows.

Either way, the higher rate of discovery suggests that fewer gamma-ray bursts are lacking optical afterglows than once thought. "This new HETE result implies that we now have a way to study most gamma-ray bursts, not just a meager one-third," Ricker adds.

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